An X-ray spectrometry and absorption spectroscopy study of blue-and-white glazes from ancient Chinese porcelains *

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Ancient Chinese porcelains have been lately the object of compositional studies to ascertain the period and the site of production [e.g.,1,2]. In fact, after the maritime contact started by the Portuguese navigators in the XVI century, the trade of blue–and-white Chinese porcelains to Europe was intensified along the XVII century and nowadays European museums and traders have an increased need for certifying the authenticity of such art objects.

Blue glazes owe its colouring mainly to either cobalt or copper employed separately or to both chromophore elements added together to the siliceous matrix in order to produce the desired tonality. Once the speciation sate of these metallic elements embedded in the glass controls the final colouring effect, X-ray absorption spectroscopy using synchrotron radiation is particularly suitable to interpret the pigmenting performance through non-invasive assays. Simultaneously, the bulk chemistry of a Chinese glaze – namely, the presence of lead and arsenic, plus manganese/iron and cobalt/copper relative contents as determined through non-invasive X-ray spectrometry assays – may be confirmative of a preliminary dating by Art Historians based on stylistic features.

A study of Chinese porcelain fragments recovered during archaeological excavations recently conducted in Lisbon Old-City (severely destroyed by the earthquake of November 1755) was carried out through a non-destructive chemical characterization using laboratorial X-ray fluorescence spectrometry (XRF-WDS), followed by a X-ray absorption spectroscopy study at the Co *K*-edge undertaken on selected cobalt-rich blue glazes to ascertain the speciation state of this chromophore element. XANES and EXAFS spectra were collected in fluorescence yield mode using the instrumental set-up of beam line BM-29 at the ESRF in Grenoble/France. Obtained spectroscopic results are described and discussed, confirming a (2+) valence state of cobalt and corroborating a mean coordination number slightly higher than four around Co^{2+} ions.

References

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